Waves and Transmission

1) A wave travelling along a spring has a speed of 12.0 m/s and a wavelength of 8.00 m. After transmission, the wave has a speed of 20.0 m/s. What is the wavelength of the new wave?

$v_1 = 12.0\,m/s$
$\lambda_1 = 8.00\,m$
$v_2 = 20.0\,m/s$
$\lambda_2 = ?$

$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$

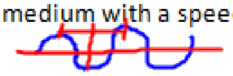
$\frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$

$\frac{v_2 \lambda_1}{v_1} = \lambda_2$

$\lambda_2 = \frac{20.0\,m/s\,(8.00\,m)}{12.0\,m/s}$

$\boxed{\lambda_2 = 13.3\,m}$

2) The distance between the crest and the trough of a wave is 2.6 m. When the wave moves to a new medium with a speed of 9.5 m/s and a wavelength of 1.00 m, what is the speed in the initial medium?



$v_1 = ?$
$\lambda_1 = 2.6\,m(2) = 5.2\,m$
$v_2 = 9.5\,m/s$
$\lambda_2 = 1.00\,m$

$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$

$v_1 = \frac{\lambda_1 v_2}{\lambda_2}$

$v_1 = \frac{5.2\,m\,(9.5\,m/s)}{1.00\,m}$

$\boxed{v_1 \simeq 49\,m/s}$

3) A wave's length changes from 150 m to 225 m when it switches media. What is the new speed of the wave if it was initially moving at 2.00 km/s?

$\lambda_1 = 150\,m$
$\lambda_2 = 225\,m$
$v_1 = 2.00\,km/s = 2.00 \times 10^3\,m/s$
$v_2 = ?$

$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$

$\frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$

$v_2 = \frac{\lambda_2 v_1}{\lambda_1}$

$v_2 = \frac{225\,m\,(2.00 \times 10^3\,m/s)}{150\,m}$

$v_2 = 3000\,m$

$\boxed{v_2 \simeq 3.0 \times 10^3\,m/s}$

4) The frequency of a wave moving at 25.0 m/s is 50.0 Hz. If the wavelength increases by 20.0 m when it switches media, what is the speed of the wave in the second medium?

$v_1 = 25.0\,m/s$
$f_1 = 50.0\,Hz$
$\lambda_1 = ?$
$\lambda_2 = \lambda_1 + 20.0\,m$
$v_2 = ?$

Find λ_1

$v_1 = f_1 \lambda_1$

$\frac{v_1}{f_1} = \lambda_1$

$\frac{25.0\,m/s}{50.0\,Hz} = \lambda_1$

$0.500\,m = \lambda_1$

$\therefore \lambda_2 = 20.5\,m$

$v_2 = \frac{\lambda_2 v_1}{\lambda_1}$

$v_2 = \frac{20.5\,m\,(25.0\,m/s)}{0.500\,m}$

$v_2 = 1025\,m/s$

$\boxed{v_2 \simeq 1030\,m/s}$

5) Blue light in air has a frequency of 4.75×10^{-7} Hz. What is the wavelength in glass for blue light if it travels at 2.00×10^{8} m/s?

$f_1 = 4.75 \times 10^{-7}$ Hz
$v_1 = 3.00 \times 10^{8}$ m/s
$\lambda_1 = ?$
$v_2 = 2.00 \times 10^{8}$ m/s
$\lambda_2 = ?$

$v_1 = f_1 \lambda_1$

$\frac{v_1}{f_1} = \lambda_1$

$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$

$\frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1}$

$\lambda_2 = \frac{v_2 \lambda_1}{v_1}$

$\frac{v_2 \frac{v_1}{f_1}}{v_1} = \lambda_2$

$\frac{v_2 v_1}{v_1 f_1} = \lambda_2$

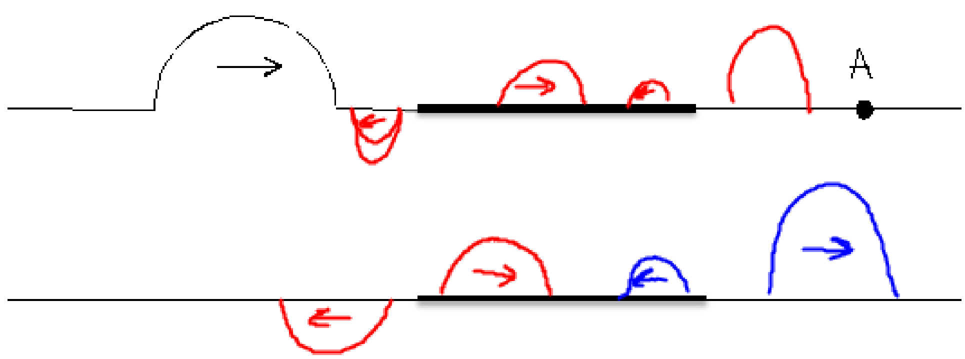
$\lambda_2 = \frac{v_2}{f_1}$

$\lambda_2 = \frac{2.00 \times 10^{8} \text{ m/s}}{4.75 \times 10^{-7} \text{ Hz}}$

$\lambda_2 = 4.2105263416 \times 10^{14}$ m

$\lambda_2 \approx 4.21 \times 10^{14}$ m

6) When the pulse gets to 'A' there will be three pulses on the media. Draw these pulses on the blank media. Draw arrows in the wave to indicate direction.



7) Draw the reflected pulses on the blank media.